



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/524,325

09/01/2005

Rodney J Allam

34875

1156

21186

7590

11/04/2008

SCHWEGMAN, LUNDBERG & WOESSNER, P.A.

P.O. BOX 2938

MINNEAPOLIS, MN 55402

EXAMINER

LEUNG, JENNIFER A

ART UNIT

PAPER NUMBER

1797

MAIL DATE

DELIVERY MODE

11/04/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/524,325	<b>Applicant(s)</b> ALLAM ET AL.	
	<b>Examiner</b> JENNIFER A. LEUNG	<b>Art Unit</b> 1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 July 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-19, 21-25 and 27-29 is/are pending in the application.
- 4a) Of the above claim(s) 1-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 19, 21-25 and 27-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Response to Amendment*

1. The amendment filed on July 30, 2008 has been carefully considered. Claims 20 and 26 are cancelled. Claims 1-18 are withdrawn. Claims 19, 21-25 and 27-29 are under consideration.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 19, 22-24 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461).

Regarding claim 19, Banquy (FIGs. 1-5) discloses an apparatus comprising:  
a syngas generation system (i.e., comprising a "primary steam reforming" zone and a "secondary oxygen reforming" zone; in detail in FIG. 2) generating syngas **11** by reaction of methane **2** with steam **5** and/or an oxidant comprising oxygen **8**, (see, for example, column 6, line

Art Unit: 1797

19 to column 9, line 3);

a syngas conversion system (i.e., a “synthesis loop”; in detail in FIG. 3) converting syngas **11** into higher molecular weight hydrocarbon compounds or oxygenates **14** and producing an offgas **15**, (see, for example, column 9, lines 13-46); and a physical separation zone for separating the various components contained in the offgas **15** produced by the syngas conversion system.

Banquy discloses that “[a]ny physical separation process can be used” in the physical separation zone and, in particular, “[t]he physical separation can... be achieved by cryogenic techniques, or distillation at low temperature, such as outlined in *Chemical Engineering Progress*, February 1980, pages 72-79 ...” to Davis et al. (see column 9, lines 55-68).

Looking to the cited publication, Davis et al. teaches a physical separation zone (see Figure 2, showing the “methane wash approach”) that separates a feed gas into a hydrogen product, a CO product, and a fuel; wherein the separation zone comprises:

a cryogenic separation system (i.e., a methane wash column) that produces the hydrogen product (i.e., in the overhead) and a first cryogenic liquid stream comprising carbon monoxide (i.e., in the bottoms); and

a cryogenic distillation column (i.e., CO/CH<sub>4</sub> fractionator) for separating carbon monoxide from the first cryogenic liquid stream to produce the CO product (i.e., in the overhead) and substantially carbon monoxide-free cryogenic liquid (i.e., in the bottoms), usable as fuel; (see also page 74, beginning of column 2, to page 75, end of column 1).

The collective teaching of Banquy and Davis et al., however, is silent as to the physical separation zone having the instantly claimed configuration of a first liquid methane wash

Art Unit: 1797

column, a second liquid methane wash column, a nitrogen rejection column, and a cryogenic distillation column.

McNeil et al. teaches a physical separation zone (see Figure 1; generally, column 4, line 7 to column 7, line 67) that, similarly to Davis et al., separates a feed gas **1** into a hydrogen product **54**, a CO product **44**, and a fuel **53**; wherein the separation zone comprises:

a first liquid methane wash column (i.e., a column **8**, supplied with liquid methane from line **36** and pump **38**) configured to separate hydrogen from the feed gas **1** to produce a separated hydrogen product that is substantially free of carbon monoxide (i.e., leaving as overhead, via line **12** to the hydrogen rich product line **54**) and a first cryogenic liquid comprising carbon monoxide and residual hydrogen (i.e., leaving as bottoms, via line **13**), (see column 5, line 56 to column 6, line 2; column 6, lines 54-56);

a second liquid methane wash column (i.e., a column **15**, supplied with liquid methane from line **14**) configured to separate the residual hydrogen from the first cryogenic liquid (i.e., fed by line **13**) to produce separated hydrogen usable as a fuel by-product (i.e., leaving as overhead, via line **19** to the fuel gas product line **53**) and a second cryogenic liquid comprising carbon monoxide (i.e., leaving as bottoms, via line **18**), (see column 6, lines 7-24; column 7, lines 21-67);

a nitrogen rejection column (i.e., nitrogen-separation fractionation column **22**) configured to separate nitrogen (i.e., leaving as overhead, in line **25**) from said second cryogenic liquid (i.e., fed by line **18**) to produce a third cryogenic liquid (i.e., leaving as bottoms, in line **26**), (see column 6, lines 25-37); and

a cryogenic distillation column (i.e., a methane-separation fractionation column **32**)

Art Unit: 1797

configured to separate carbon monoxide from said third cryogenic liquid (i.e., fed by line **26**) to produce separated carbon monoxide product (i.e., leaving as overhead, in line **35** to the CO product line **44**) and a substantially carbon monoxide-free cryogenic liquid (i.e., leaving as bottoms, in line **36**), (see column 6, lines 38-53).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to select the physical separation zone as taught by McNeil et al. for the physical separation zone in the apparatus of Banquy, because any physical separation process can be used, and a physical separation process employing cryogenic techniques or distillation at low temperature is specifically suggested as being suitable (see Banquy: column 9, lines 55-65). Like the cited publication to Davis et al., the physical separation zone of McNeil et al. similarly separates a feed gas into a hydrogen product, a CO product, and a fuel. However, one having ordinary skill in the art would have been motivated to provide the physical separation zone of McNeil et al. in the apparatus of Banquy because, unlike conventional cryogenic techniques (such as Davis et al.), the separation zone of McNeil et al. further removes nitrogen contaminant from the carbon monoxide product, which is desirable for environmental and processing reasons (see McNeil et al.: column 1, lines 16-35).

Regarding claim 22, Banquy discloses (see column 9, lines 47-54, with emphasis added),

“The purge gas (stream **15**) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and *a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.*”

Therefore, it would have been obvious for one of ordinary skill in the art at the time the

Art Unit: 1797

invention was made to provide a conduit means for feeding separated carbon monoxide product from the physical separation zone to the syngas conversion system in the modified apparatus of Banquy, because the provision of conduit means for enabling the transport of fluids between different zones of an apparatus is conventional in the art, and such conduit means would enable the separated carbon monoxide product (i.e., the carbon oxides from the residual gas stream) to be recycled as fuel to the primary steam reformer, as specifically suggested by Banquy, above.

Regarding claim 23, Banquy further discloses that the residual gas stream contains argon (see column 9, lines 46-54). Thus, the modified apparatus of Banquy inherently comprises conduit means for removing an argon-enriched stream from a location in the region of high argon concentration in the cryogenic distillation column (i.e., via the bottoms of the methane-separation fraction column **32**, as taught by McNeil et al.; see column 5, lines 10-13).

Regarding claim 24, Banquy discloses (see column 9, lines 47-54, with emphasis added),

“The purge gas (stream **15**) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and *a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.*”

Therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide a conduit means for feeding separated methane product from the physical separation zone to the syngas conversion system in the modified apparatus of Banquy, because the provision of conduit means for enabling the transport of fluids between different zones of an apparatus is conventional in the art, and such conduit means would enable the methane product (i.e., methane from the residual gas stream) to be recycled as fuel to the primary

Art Unit: 1797

steam reformer, as specifically suggested by Banquy, above.

Regarding claim 27, Banquy (see column 9, lines 47-54, with emphasis added) discloses,

*“The purge gas (stream 15) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.”*

As seen in FIGs. 1, 4 and 5, the apparatus further comprises conduit means **12** for removing a portion of the separated hydrogen product, in order to recycle the hydrogen to the syngas conversion system (i.e., the synthesis loop) for generation of higher molecular weight hydrocarbon compounds or oxygenates **14**. Please note that the recitation of a particular molar concentration of helium within the separated hydrogen product stream is considered a process limitation that adds no further patentable weight to the apparatus claim.

Regarding claim 28, Banquy (FIG. 2) discloses that the syngas generation system comprises a partial oxidation reactor (i.e., a secondary oxygen reformer **R**; see column 7, lines 3-42) and an enhanced heat transfer reformer (i.e., an endothermic primary steam reforming reactor **F**, having catalyst containing reforming tubes heated externally by burners; see column 6, lines 43-64).

Regarding claim 29, Banquy discloses that the syngas conversion system comprises at least one FT reactor (i.e., a synthesis converter **SC**, for reacting hydrogen with carbon monoxide, carbon dioxide or mixtures of these carbon oxides to yield organic compounds, such as a hydrocarbon, a mixture of hydrocarbons, an oxygenated compound, or any mixture thereof (see FIG. 3; see column 9, lines 4-46; also, column 1, lines 10-17, lines 20-34).



Art Unit: 1797

3. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. (“Cryogenics for Syngas Processing”, *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461), as applied to claim 19 above, and further in view of Ireland et al. (US 4,044,063).

The collective teaching of Banquy, Davis et al. and McNeil et al. is silent as to the apparatus further comprising a hydrogenation system.

Ireland et al. (FIG. 1; see, for example, column 8, line 15 to column 9, line 3) teaches a hydrogenation system (e.g., hydrotreating unit **56**; or hydrodewaxing unit **62**) for hydrogenating a fraction of the higher molecular weight hydrocarbon compounds **54**, **60** produced by a syngas conversion system (i.e., in F-T synthesis zone **4**). It would have been obvious for one of ordinary skill in the art at the time the invention was made to further provide a hydrogenation system to the modified apparatus of Banquy, on the basis of suitability for the intended use thereof, because the provision of a hydrogenation system helps maximize the production of further liquid hydrocarbon products from the Fischer-Tropsch reaction products stream, as taught by Ireland et al.

4. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. (“Cryogenics for Syngas Processing”, *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461), as applied to claim 19 above, and further in view of Keller (US 4,650,814).

Banquy discloses that “[a]ny physical separation process can be used” in the physical separation zone and, in particular, “[a]nother physical separation for this purpose is the membrane separation process, which is described in Hydrocarbon Processing May 1980 pages

Art Unit: 1797

115-118, and July 1980 pages 65-67,” (column 9, lines 55-68). The collective teaching of Banquy, Davis et al. and Martin, however, is silent as to the provision of a membrane separation system, for removing helium from the separated hydrogen product.

Keller (FIG. 3) teaches a membrane separation system **325** for removing inert gases **344** such as helium (see column 7, lines 6-17) from a separated hydrogen product stream **330**. (see column 13, line 10 to column 14, line 34; see column 15, lines 10-36; see also FIG. 1, column 8, line 14 to column 9, line 8). It would have been obvious for one of ordinary skill in the art at the time the invention was made to further provide a membrane separation system in the modified apparatus of Banquy, on the basis of suitability for the intended use thereof, because the membrane separation system enables the generation of a high purity hydrogen stream for use as a recycle, while minimizing the amount of inert compound build-up in the system by separating and removing any inert gases, such as helium, from the system, as taught by Keller.

### ***Response to Arguments***

5. Applicant's arguments filed July 30, 2008 have been fully considered but they are not persuasive. Applicant (near top of page 9) argues,

“The cited portions of Banquy include several references, including Davis, for the "physical separation zone". As stated in the Office Action, Banquy discloses that "[a]ny physical separation process can be used", together with examples of this process that are "specifically suggested as being suitable". It is therefore believed that one of ordinary skill in the art would be motivated to choose one of these examples.”

Applicant (last two paragraphs on page 9) further argues,

“... according to McNeil, nitrogen in carbon monoxide is unacceptable or problematic only for some uses of carbon monoxide. Applicant is unable to find in Banquy a reason for the presence of nitrogen to be unacceptable or problematic in its use

Art Unit: 1797

of carbon monoxide. Applicant is also unable to find such a reason articulated in the Office Action.

Specifically, Banquy states that the physical separation processes results in "a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen, and some hydrogen, and which can be used as fuel in the primary stream reformer" (column 9, lines 47-54). Applicant is unable to find in Banquy or the Office Action that the residual gas stream including nitrogen, resulting from "conventional cryogenic techniques (such as Davis et al.)", is unacceptable or problematic for environmental and processing reasons when "used as fuel in the primary stream reformer". Additionally, by stating that "[a]ny physical separation process can be used" and providing various examples of "conventional cryogenic techniques", Banquy appears to teach away from a need for using McNeil's physical separation zone."

The Examiner respectfully disagrees.

Firstly, disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or nonpreferred embodiments. *In re Susi*, 440 F.2d 442, 169 USPQ 423 (CCPA 1971). See also MPEP 2123.

Secondly, Banquy discloses that the residual gas stream, containing essentially methane, carbon oxides, argon, nitrogen and some hydrogen, may be used as *fuel* for heating the primary steam reformer. As is well known to those of ordinary skill in the art, the combustion of fuel occurs at a sufficiently high temperature for driving the reactions between nitrogen and oxygen, which thereby yields various oxides of nitrogen. (see, e.g., Perry's Chemical Engineers' Handbook, pages 27-26 to 27-27). The oxides of nitrogen (NO<sub>x</sub>) are considered atmospheric pollutants. Thus, one of ordinary skill in the art would have been motivated to minimize the nitrogen content in the residual gas stream of Banquy, in order to minimize the amount of nitrogen available for generating nitrogen oxides when the residual gas stream is combusted as

Art Unit: 1797

fuel. And, as noted above, McNeil et al. specifically teaches that nitrogen removal would be desirable for “environmental” reasons (see column 1, lines 16-35).

***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

\* \* \*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER A. LEUNG whose telephone number is (571) 272-1449. The examiner can normally be reached on 9:30 am - 5:30 pm Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Glenn A. Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

Art Unit: 1797

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer A. Leung/  
Primary Examiner, Art Unit 1797